

REMARKS

On page 3 of the Office Action, in paragraph 5, claims 1, 3, 4, 33 and 34 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Daido et al (US 6,291,106). On page 4 of the Office Action, in paragraph 6, claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daido et al (US 6,291,106) in view of Shinohara et al (US 6,447,958). On page 4 of the Office Action, in paragraph 7, claims 5-7 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daido et al (US 6,291,106) in view of Tsutsumi et al (US 5,571,875). On page 5 of the Office Action, in paragraph 8, claims 1, 3-6, 33, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinohara et al (US 6,447,958) in view of Cieslak et al (US 5,002,843).

Applicants respectfully submit that the present invention is neither anticipated by nor obvious over the cited references alone or in combination, and request that the Examiner reconsider and withdraw these rejections in view of the following remarks.

1. Concerning the Rejection based on Daido et al (US 6,291,106)

(1-1) As indicated by the examiner in the February 23, 2007 Office Action (below referred to as the "Office Action"), page 3, lines 3 to 10, it is true that the reinforcing material of Daido (the porous film indicated by the examiner) has a gas permeability of 20 sec/100 ccxⁱⁿ² or less and a porosity of 62% and that these overlap with part of the numerical range in the m-aramid-based polymer porous film of the present invention. However, Applicants submit that this does not constitute grounds for denying the patentability of the present invention. That is, as stated in the previous argument as well, the porous film according to the present invention can be used as a battery separator in the state as it is, but the reinforcing material of Daido cannot be used as a battery separator as it is. The reinforcing material of Daido can only be used as a

battery separator by combining it with an electrolytic solution supporting polymer to make a solid polymer electrolyte membrane. This can probably be easily understood if viewing Figs. 1 to 3 of the attached Rule 132 Declaration executed by Mr. Nishikawa. Consequently, in confirming the patentability of the present invention, comparing the various parameters of the porous film of the present invention and the various parameters of the reinforcing material of Daido has no meaning.

(1-2) Further, the examiner stated in the Office Action, page 3, lines 10 and 11, that the porous film of Daido is suitable for a battery separator (column 4, lines 25 to 30), but this interpretation is incorrect. That is, Daido, column 4, lines 25 to 30 states that the puncture strength of the electrolytic solution supporting polymer film of the invention being in a predetermined range is preferable in order to show sufficient strength when the electrolytic solution supporting polymer film is designed as a battery. However, that the porous film of Daido is suited for a battery separator cannot be completely read at all from this statement. Rather, Daido, column 5, lines 13 to 23 states that, as for the electrolytic solution supporting polymer film, it is important that the surface of the reinforcing material be completely covered with the electrolytic solution supporting polymer, and where the reinforcing material is exposed, it is difficult to accomplish a good interfacial junction between a positive electrode and a negative electrode when the battery is formed. This statement can also be read as meaning that the reinforcing material of Daido cannot itself be used as a battery separator.

(1-3) The examiner stated in the Office Action, page 3, lines 11 to 21, that Daido does not specifically disclose the cross-sectional pore laminar coefficient, specific Young's modulus and percent of gas permeability retained after heat treatment at 350°C for 10 minutes, but if the porous film of Daido uses the same material having the same thickness, porosity and density,

there are not thought to be any differences between the present invention and Daido in the cross-sectional pore laminar coefficient, specific Young's modulus, and percent of gas permeability. However, this interpretation is also improper. Usually, even if two compared materials use the same raw materials and have the same thickness, porosity, and density, if the structures are different, the strength and gas permeability and other physical properties also will naturally differ. These physical property values are not known unless actually conducting experiments. This should be easily understood if comparing Fig. 1 (the porous film of the present invention) and Fig. 2 (the non-woven fabric of Daido) of the attached Declaration. Of course, the reinforcing material of Daido cannot be used as a battery separator as it is, so there is no meaning in debating the cross-sectional pore laminar coefficient, specific Young's modulus, and percentage of gas permeability between the present invention and Daido.

(1-4) The examiner stated in the Office Action, page 6, line 21 to page 7, line 7 that Daido, column 7, lines 60 to 65 states that the porous reinforcing material is a thin film having a three-dimensional network structure and that the porous film of the invention can be read from that. However, the meaning of a porous structure cannot be unambiguously derived from the term "three-dimensional network structure". Further, a porous structure of a cross-sectional pore laminar coefficient of 2.5 or more like in the porous film of the present invention cannot be read from the term "three-dimensional network structure".

(1-5) The examiner stated in the Office Action, page 7, line 17 to page 8, line 2 that because the porous film of Daido has a thickness up to 100 μm and because it should have at least three pores existing between the fibers in the thickness direction of the porous film, the porous film of Daido should have a cross-sectional pore laminar coefficient within the same range in the porous film of the present invention. However, this interpretation is also improper.

Originally, the spaces between one fiber and another fiber in a non-woven fabric completely differ from the pores in a porous film, so the concept of a "cross-sectional pore laminar coefficient" should not be applied to a non-woven fabric. Further, the cross-sectional pore laminar coefficient is a value determined by the size of the pores and the thickness of the porous film and is not determined by the number of pores. Consequently, even if the porous film of Daido has a thickness of 100 μm and there are three or more pores in the thickness direction of the porous film, unless the size of the pores is known, the cross-sectional pore laminar coefficient cannot be identified. On this point, Daido does not specifically describe the size of the pores or the size of the spaces between the fibers. It is possible to deduce the dimension of the space between one fiber and another in a non-woven fabric from Example 1 of Daido, but even if forcibly applying the concept of a cross-sectional pore laminar coefficient to a non-woven fabric, as shown in the attached Declaration, the cross-sectional pore laminar coefficient of Example 1 would be 1.5. This is outside the range of "2.5 or more" in the present invention. Consequently, it is not possible to derive the cross-sectional pore laminar coefficient of the present invention from the statements of Daido.

(1-6) Due to the above reasons, Applicants submit that the patentability of the inventions of claims 1, 3, 4, 33, and 34 cannot be denied based on the description of Daido under either 35 U.S.C. 102(e) or 35 U.S.C. 103(a).

2. Concerning the Rejection based on Daido et al (US6,291,106) and Shinohara et al (US6,447,958)

(2-1) First, as stated above, the reinforcing material of Daido is not a battery separator, so it is improper to use this as the grounds for denying the patentability of the inventions of claims 5 and 6.

(2-2) The examiner stated in the Office Action, page 4, lines 4 to 12 that based on the statement of Shinohara (column 3, lines 40 to 55, column 8, lines 1 to 3), addition of ceramic powder to a film for the purpose of imparting mechanical strength and dimensional stability would have been self evident to a person skilled in the art. However, this interpretation is not suitable. First, Shinohara, column 5, lines 17 to 22 states when the content of the ceramic powder is less than 1% by weight of the nonaqueous electrolyte battery separator, the effect promoting ion permeability and battery property may not be sufficient, and when over 95% by weight, the separator may become fragile and handling thereof may become difficult. Further, if looking at Shinohara, Examples 1 to 9 and Comparative Example 1, it is understood that as the amount of addition of alumina powder increases, the permeability of the separator increases. From this, one of the effects of the addition of a ceramic powder of Shinohara is deemed to be raising the permeability of the separator and improving the battery properties. Further, Shinohara, column 10, lines 29 to 39 describes that because ceramic powder has excellent heat resistance, a non-aqueous electrolyte battery using the separator maintains its shape until a high temperature and manifests excellent safety. From this, the second of the effects of addition of the ceramic powder of Shinohara is deemed to be the improvement of safety under a high temperature. However, these effects differ from the improvement of the mechanical strength and dimensional stability in the film as pointed out by the examiner. Consequently, addition of a ceramic powder to film for the purpose of imparting mechanical strength and dimensional stability could not have been arrived at by a person skilled in the art based on the descriptions of Shinohara and Daido.

(2-3) The examiner stated in the Office Action, page 8, lines 3 to 8 that the applicants argue that the separator of Shinohara is not porous when the content of the powder is less than

1%, that the separator of Shinohara can be said to be porous when the content of the ceramic powder is 1% or more, and that this suggests that the applicants agree that no significant difference is found between the separator of the present invention and the separator of Shinohara. This is a misunderstanding of the examiner. Rather, the applicants argued that the separator of the present invention and the separator of Shinohara are remarkably different. That is, the p-aramid-based polymer of Shinohara has a strong correlation between the amount of addition of the ceramic powder and the porosity of the film, so pores are hard to form in the film when the ceramic powder is less than 1%. On the other hand, the m-aramid-based polymer of the present invention has a weak correlation of the amount of addition of the ceramic powder and the porosity of the film, so many pores can be formed in the film even without adding ceramic powder. That is, m-aramid-based polymers and p-aramid-based polymers have remarkably different mechanisms of formation of pores in the film and therefore there are remarkable points of difference between the separator of the present invention and the separator of Shinohara. Note that this appears to contradict the statement of Shinohara that a p-aramid-based polymer is preferable since it tends to become porous (column 3, lines 55 to 56), but is a fact based on research by the inventors in good faith.

(2-4) The examiner stated in the Office Action, page 8, lines 9 to 13 that nothing specific about the difference between the shapes of the fillers of the invention and the shapes of the fillers of Shinohara could be found. However, "whisker" is stated in claim 5 of the present invention. "Whisker" is a word having the meaning "a fine fibrous substance having a specific aspect ratio". This is a matter of common knowledge in the technical field of the present invention. On the other hand, Shinohara, column 5, lines 22 to 24 states that as the form of the ceramic powder ... spheres and random forms can also be used, but the special configuration of the whisker shape

like the present invention is not clearly stated. Consequently, the fillers of the invention and the fillers of Shinohara differ clearly in the form of the whiskers.

(2-5) Originally, the invention of claim 5 was made based on the finding that if the inorganic matter is whisker shaped, the specific Young's modulus of an m-aramid-based polymer porous film can be improved. However, Shinohara has no description regarding this point. Consequently, adding inorganic whiskers to a film to improve the specific Young's modulus could not have been arrived at by a person skilled in the art based on the statements in Shinohara. Further, Shinohara does not have any description of the specific Young's modulus of an m-aramid-based polymer porous film being 2 to 5000 (kgf/mm²)/(g/cm³) in numerical range. This numerical range is first obtained by experiments. Applicants submit that the reasoning that the numerical range is self-evident from the statements of Shinohara despite the fact that Shinohara has no examples using an m-aramid-based polymer and inorganic whiskers cannot be accepted.

(2-6) Due to the above reasons, Applicants submit that the patentability of the inventions of claims 5 and 6 cannot be denied based on the statements of Daido and Shinohara under 35 U.S.C. 103(a).

3. Concerning the Rejection based on Daido et al (US 6,291,106) and Tsutsumi et al (US 5,571,815)

(3-1) First, as stated above, the reinforcing material of Daido is not a battery separator, so it is improper to use this as grounds to deny the patentability of the inventions relating to claims 5 to 7 and 35.

(3-2) The examiner stated in the Office Action, page 4, lines 16 to 18 that Tsutsumi teaches a polyamide-based resin composition that is excellent in processibility and has improved mechanical characteristics (column 3, lines 5 to 10). However, this effect, as will be understood

if viewing Tsutsumi, column 3, lines 8 and 9, is an effect obtained by increasing the crystallization rate and is not an effect obtained by adding potassium titanate whiskers. Further, the examiner stated, based on the statements of Tsutsumi, column 20, lines 30 to 50 and column 22, lines 30 to 33, that the resin composition of Tsutsumi provides a polyimide resin, a poly-meta-phenyleneisophthalamide, a fiber length L of 5 to 50 μm , and a fiber diameter D of the inorganic whiskers of 0.05 to 1 μm . However, as will be understood if carefully viewing the locations indicated by the examiner, a polyimide resin composition containing a poly-meta-phenyleneisophthalamide is described independently as composition C, a polyimide resin composition containing inorganic whiskers comprised of potassium titanate whiskers is described independently as composition F, and the differences of the resin compositions are described. Consequently, a resin composition provided with a polyimide resin, poly-meta phenyleneisophthalamide, a fiber length L of 5 to 50 μm , and fiber diameter D of inorganic whiskers of 0.05 to 1 μm pointed out by the examiner is not described in Tsutsumi. The examiner tries to combine individual facts stated in Tsutsumi so as to deny the patentability of the invention, but the individual facts lack any interrelationship, so Applicants submit that the reasoning based on this kind of combination cannot be accepted.

(3-3) Originally, the resin forming the basis of the present invention is an m-aramid-based polymer, while the resin forming the basis of Tsutsumi is a polyimide. The two are resins greatly differing in their polymer structures, properties, and characteristics. Because of this, just because Tsutsumi discloses a polyimide resin composition containing potassium titanate whiskers, it is impossible to predict that similar physical property values would be obtained as with the resin composition of Tsutsumi even if adding potassium titanate whiskers to an m-aramid-based polymer. Further, the ratio L/D of the long axis dimension L and the minor axis

dimension D of the inorganic whiskers in the invention being 1.5 or more and the specific Young's modulus of the porous film being 2 to 5000 (kgf/mm²)/(g/cm³) are not described in Tsutsumi at all. These numerical ranges are first obtained by experiments. Applicants submit that the reasoning that the numerical ranges are self-evident from the statements of Tsutsumi despite Tsutsumi not having any examples using an m-aramid-based polymer cannot be accepted.

(3-4) Due to the above reasons, Applicants submit that the patentability of the inventions of claims 5 to 7 and 35 cannot be denied based on the statements of Daido and Tsutsumi under 35 U.S.C. 103(a).

4. Concerning the Rejection based on Shinohara et al (US6,447,958) and Cieslak et al (US5,002,843)

(4-1) The examiner, in the Office Action, page 5, line 11 to page 6, line 1 and page 6, lines 9 to 19, denies the patentability of the inventions which depends on claims 1, 3 to 6, 33, and 34 based on the statements of Shinohara, column 3, lines 40 to 55, column 5, lines 65 to 67, column 10, lines 20 to 22, column 18, lines 8 to 10, column 8, lines 1 to 3, and column 3, lines 55 to 56. However, this interpretation is not appropriate based on the following reasons.

(4-2) The gas permeability of 680 cc/sec disclosed in Shinohara (column 18, lines 8 to 10) indicated by the examiner is the gas permeability of a separator consisting of a polyimide resin (Example 4) and is not the gas permeability of a separator consisting of an m-aramid-based polymer. Consequently, Shinohara does not disclose the gas permeability of an m-aramid-based polymer porous film of the present invention. The interpretation of the examiner based on this point (Office Action, page 6, lines 9 to 19) is not suitable.

(4-3) As also recognized by the examiner, Shinohara does not disclose specific numerical ranges for the cross-sectional pore laminar coefficient, specific Young's modulus, and gas permeability after heat treatment at 350°C for 10 minutes. These numerical ranges are obtained first by experiments. Applicants submit that the reasoning that these numerical ranges are self-evident from the statements of Shinohara despite Shinohara not having any examples using an m-aramid-based polymer cannot be accepted.

(4-4) As explained above, Shinohara does not describe adding ceramic powder to film for the purpose of increasing the mechanical strength and dimensional stability. Further, the ceramic powder being a whisker form is also not described. Consequently, addition of inorganic whiskers for imparting mechanical strength to a film could not have been arrived at by a person skilled in the art based on Shinohara. Further, Shinohara does not have any description concerning the specific Young's modulus rate of 2 to 5000 (kgf/mm²)/(g/cm³) as in the present invention. The numerical range is obtained for the first time by experiments. Applicants submit that the reasoning that the numerical range is self-evident from the statements of Shinohara despite Shinohara not having any examples using an m-aramid-based polymer cannot be accepted.

(4-5) Cieslak describes the point of using a meta-type aromatic isophthalamide fibers for the separator. Cieslak has no relationship with the present invention which uses an m-aramid-based polymer porous film as a separator.

(4-6) Due to the above reasons, Applicants submit that the patentability of the inventions of claims 1, 3 to 6, 33, and 34 cannot be denied based on the statements of Shinohara and Cieslak under 35 C.S.C. 103(a).

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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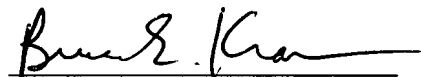
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